(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 May 2003 (01.05.2003)

PCT

(10) International Publication Number
WO 03/035189 A1

(51) International Patent Classification[7]: A63B 69/36

(21) International Application Number: PCT/KR02/00623

(22) International Filing Date: 9 April 2002 (09.04.2002)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
2001/58821 22 September 2001 (22.09.2001) KR

(71) Applicant and
(72) Inventor: KWON, Oh, Seok [KR/KR]; 257-27 Yeonmoo-dong, Jangan-ku, Suwon-si, Kyungki-do 440-240 (KR).

(74) Agent: KIM, Kook, Nam; 2 Fl., Shindo Bldg., 823-10 Yeoksam-dong, Kangnam-ku, Seoul 135-080 (KR).

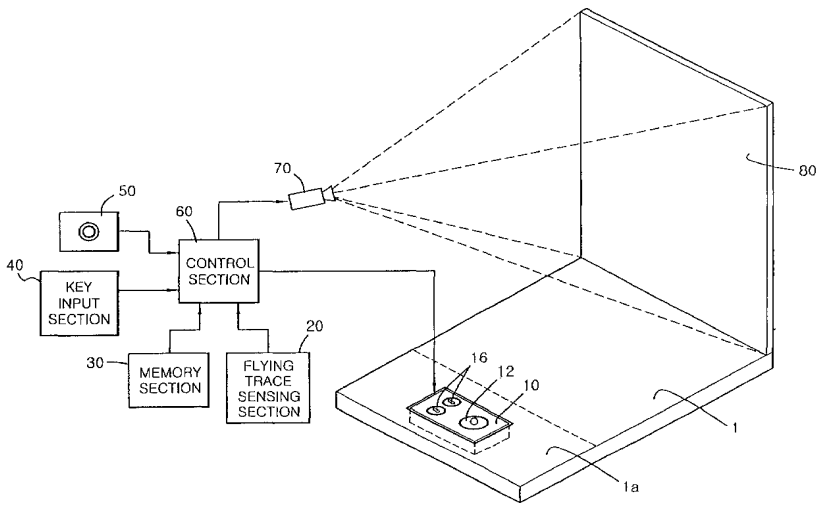
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SIMULATION SYSTEM FOR GOLF PRACTICE



(57) Abstract: In a golf simulation system, a setting plate for locating a golf ball is provided in a striking zone, and a setting plate adjusting means is provided below the setting plate. A control section calculates moved distance and stoppage position of golf ball based on the flying trace of golf ball sensed by the flying trace sensing means, and inputs signals reflecting the three-dimensional images of the golf course along the flying trace into the projector, so that the three-dimensional images are displayed on the projection screen. Also, the control section controls the setting plate adjusting means in accordance with the height and inclined angle of the stoppage position, so that the setting plate can be automatically adjusted to the height and inclined angle equal to those of the stoppage position. Therefore, a golfer can exercise golf in various inclined angles and topographical conditions like a real golf course.

WO 03/035189 A1

SIMULATION SYSTEM FOR GOLF PRACTICE

Technical Field

The present invention relates to a golf simulation system, and in particular to a golf simulation system constructed such that a golf ball setting plate is automatically controlled in its height and inclined angle to be in conformity with those of a position at which a struck golf ball is stopped, whereby a golfer can exercise golf in various inclined angles and topographical conditions like a real golf course and when two or more golfers play a golf game, victory or defeat can be determined according to true ability of golf like in the real golf course.

Background Art

Recently, as golf is popularized, a lot of people visit golf courses and beginners or people tied to a schedule frequently use golf practice rangers. Due to this, a golf simulation system which allows golfers to play a golf game as if enjoying golf in a real golf course have been developed, installed and utilized in golf practice rangers.

Such a golf simulation system comprises a striking zone for striking a golf ball, a flying trace sensing means for sensing the flying trace such as direction, velocity and the like of the struck golf ball, a projection screen onto which three-dimensional images of golf course projected by a projector is displayed, and a control section for outputting image signals, which proceed with the three-dimensional images of golf course in accordance with the flying trace sensed by said flying trace sensing means, into said projector.

In particular, when a golfer strikes a golf ball in the striking zone, the flying trace of struck golf ball is sensed by the flying trace sensing means and then inputted into the control

section. The control section inputted with such a data of sensed flying trace calculates the flight distance and stoppage position of golf ball and then inputs signals reflecting the three-dimensional images of the golf course along the flying trace into said projector, so that the three-dimensional images of golf course along the flying trace are displayed on said projection screen, whereby the golfer can exercise golf with a visual feeling as if playing a golf game in a real golf course.

However, the golf simulation system is constructed such that the golf ball-striking zone has a fixed height and inclined angle, whereby it allows a uniform striking practice only but renders it impossible to perform a detailed striking practice for various inclined angles and topographical conditions as in a real golf course. Accordingly, the system has a problem in that it is not only difficult to provide sufficient and satisfactory conditions of golf practice but also difficult for two or more golfers to play a golf game for contending for mastery in true ability of golf.

Disclosure of the Invention

Therefore, the present invention has been conceived in view of the above-mentioned problems, and it is an object of the present invention to provide a golf simulation system in which a golf course is displayed in three-dimensional images, wherein a golf ball setting plate, the inclined angle and height of which are adjustable, is provided in a golf ball-striking zone, and if a golf ball located on the setting plate is struck, the flying trace of struck golf ball is sensed and the moved distance and stoppage position of golf ball are calculated, and then the height and inclined angle of said setting plate are automatically adjusted to be equal to the height and inclined angle of the stoppage position, whereby a golfer can exercise golf in various inclined angles and topographical conditions like a real golf course and when two or

more golfers play a golf game, victory or defeat can be determined according to true ability of golf like in the real golf course.

In order to achieve the above object, the present invention provides a golf simulation system comprising a flying trace sensing means for sensing a golf ball struck in a striking zone provided in a side of golf practice ranger, a projection screen installed to face said striking zone, a projector for projecting three-dimensional images of golf course onto said projection screen, and a control section for outputting image signals, which proceed with the three-dimensional images of golf course in accordance with the flying trace sensed by said flying trace sensing means, into said projector, wherein a setting plate for locating a golf ball is provided in said striking zone and a setting plate adjusting means is installed below said setting plate for adjusting the height and inclined angle of setting plate, and wherein said control section calculates the moved distance and stoppage position based on the flying trace of golf ball sensed by said flying trace sensing means, inputs signals reflecting the three-dimensional images of the golf course along the flying trace into said projector, so that the three-dimensional images of the golf course along the flying trace are displayed on said projection screen, and controls said setting plate adjusting means in accordance with the height and inclined angle of said stoppage position, so that said setting plate can be automatically adjusted to the height and inclined angle equal to those of said stoppage position.

Brief Description of the Drawings

The foregoing and other objects, features and advantages of the present invention can become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

Fig. 1 is a constructional view showing an embodiment of a

golf simulation system according to the present invention;

Fig. 2 is a perspective view showing an example of a setting plate and setting plate adjusting means in Fig. 1;

Fig. 3 is a cross-sectional view of the setting plate and adjusting means shown in Fig. 2 in the assembled state; and

Figs. 4 to 9 are perspective views showing various embodiments of flying trace sensing means shown in Fig. 1, respectively.

Best Modes for Carrying Out the Invention

Herein below, a preferred embodiment of golf simulation system according to the present invention can be made in detail with reference to the attached drawings.

Fig. 1 is a constructional view showing an embodiment of a golf simulation system according to the present invention, Fig. 2 is a perspective view showing an example of a setting plate and setting plate adjusting means in Fig. 1, and Fig. 3 is a cross-sectional view of the setting plate and adjusting means shown in Fig. 2 in the assembled state. As shown in the drawings, the golf simulation system according to the present invention is installed in a golf practice ranger and comprises a setting plate 12, a setting plate adjusting means 14, a flying trace sensing means 20, a control section 60, a projector 70, and a projection screen 80.

That is, the golf practice ranger is provided with a striking zone 1a for hitting a golf ball in a side potion of bottom 1, the projection screen 80 is vertically installed in the other side opposite to the striking zone 1a, and the projector 70 is installed in a predetermined position to be directed toward said projection screen 80 for projecting three-dimensional images of golf course onto said projection screen 80.

Said flying trace sensing means 20 is a means for sensing and inputting a flying trace of golf ball struck in said striking zone, i.e., flying angle, flying velocity and the like of golf ball into

said control section 60, and various conventional techniques can be applied thereto.

For example, it can be possible to construct said flying trace sensing means 20 to comprise a plurality of light emission sensors arranged on a left side wall of golf practice ranger to be equally spaced in up and down and right and left directions, a plurality of light receiving sensors arranged on a right side wall of golf practice ranger to respectively receive light signals outputted from each of the light emission sensors, the number of light receiving sensors being equal to that of said light emission sensors, and a signal processing section inputted with data indicative of whether a light signal is received or not, from each of said light receiving sensors and calculating the flying trace of golf ball using the data and time intervals between changed data. As constructed in this manner, the receiving of light signals by certain light receiving sensors among said a plurality of light receiving sensors is temporarily interrupted by a flying golf ball in a certain time interval depending on flying angle and velocity of the golf ball, whereby it becomes possible to calculate flying angle and velocity data for the flying golf ball, based on the positional relationship of the light receiving sensors which are subjected to interruption of receiving light signals and the time intervals at which the receiving of light signals is interrupted.

Said setting plate 12 is a plate, on which a golf ball is located so that a golfer can strike the golf ball, and is positioned on the striking zone 1a in the golf practice ranger in the condition that its height and inclined angle can be adjusted, and a setting plate adjusting means is installed below said setting plate 12 for adjusting the height and inclined angle of the setting plate 12. If it is constructed so that a golf ball located on said setting plate 12 is to be struck toward said projection screen 80, it is necessary to install a net in front of said projection screen 80 or to form

the projection screen 80 itself from woven member such as cloth in order to prevent it from being destroyed by the struck golf ball.

As illustrated in Figs. 2 and 3 by way of an example, said setting plate adjusting means 14 is a means for selectively adjusting the height and inclined angle of said setting plate 12 and is installed vertically underside of said setting plate 12 and may comprise a motor 14a, a height adjusting actuator 14b and an inclination adjusting actuator 14c.

Said motor 14a is a means for rotating said setting plate 12 and is installed vertically underside of said setting plate 12 with its spindle being directed upwardly.

Said height adjusting actuator 14b is a structure for adjusting the height of said setting plate, wherein its body is fixed on the upper end of spindle of said motor 14a and the upper end of its rod is connected to the center of said setting plate 12 by a pipe-shaped ball-joint, whereby as said height adjusting actuator 14b moves up and down, said setting plate 12 can be moved up and down and the inclined angle of said setting plate 12 can be adjusted with reference to the center part to which the height adjusting actuator 14b is connected. As the height adjusting actuator 14b, it may be possible to use a manually operated lifting jack with an upwardly extended rod, as well as a hydraulic actuator, a pneumatic actuator, and an electromagnetic actuator.

Said inclination adjusting actuator 14c is a means for adjusting the inclined angle of said setting plate 12 with reference to the ball-joint connection of said setting plate 12, wherein its body is fixed on a side of said height adjusting actuator 14b and the upper end of its rod is hinged to a side of bottom surface of said setting plate 12. In this case, it is a matter of course that the hinged part of said inclination adjusting actuator 14c is located on a position spaced from the central part of setting plate 12 to which the upper end of said height adjusting actuator 14c

serving as a central axis is connected. Although not shown in the drawings, said motor 14a, height adjusting actuator 14b and inclination adjusting actuator 14c are independently operated by control signals inputted from said control section 60.

With this construction, if a control signal is inputted from said control section 60 into said height adjusting actuator 14b, the rod of said height adjusting actuator 14b is moved up and down according the inputted signal, whereby the up and down height of said setting plate 12 can be adjusted. If a control signal is inputted from said control section 60 into said inclination actuator 14c after the height was adjusted in this manner, said inclination adjusting actuator 14c can be moved up and down, thereby moving the hinged part of said setting plate 12, whereby the inclined angle of said setting plate 12 can be adjusted. Following this, if a control signal is inputted from said control section 60 into said motor 14a, said motor 14a will perform rotating movements and then said height adjusting actuator 14b and said setting plate 12 can be rotated, whereby said setting plate 12 can be rotated under the inclined state and thus the inclined direction of setting plate 12 can be adjusted.

By these successive operations, said control section 60 can adjust the height, inclined angle and inclined direction of said setting plate. For the purpose of convenience of explanation, control signals are described as if they are sequentially inputted into said height adjusting actuator 14b, inclination adjusting actuator 14c and motor 14a from said control section 60 in the above, it is a matter of course that said control signals can be made to be simultaneously inputted into each of the apparatus 14a to 14c from the input section 60 for the speediness of operation.

Said control section 60 incorporates a memory section 30 for storing three-dimensional images of real or virtual golf courses and outputs three-dimensionally proceeded golf course images to said

projector 70 according to a flying trace sensed by said flying trace sensing means 20, whereby the dimensional golf course images can be displayed on said projection screen 80.

That is, said control section 60 calculates the moved distance and stoppage position of golf ball based on the flying trace of the golf ball sensed by said flying trace sensing means 20, inputs signals of golf course images proceeded from the striking position to the stoppage position into said projector 70 to display the images on said projection screen 80. In addition, said control section 60 controls said setting plate adjusting means 14 according to the stoppage position of said golf ball and the inclined angle, whereby said setting plate 12 can be automatically adjusted to the height and inclined angle identical to those of said stoppage position of golf ball. Reference numeral 40 indicates a key input section for initializing and operational-controlling of said control section 60.

Now, the operations of golf simulation system as constructed in the above can be described.

Firstly, if a golfer strikes a golf ball located on said setting plate 12, the struck golf ball can be flied toward the projection screen 80. At this time, said flying trace sensing means 20 senses the flying trace including the velocity and flying direction of struck golf ball, and then inputs the sensed flying trace into said control section 60.

The control section inputted with the flying trace of golf ball in this manner calculates the flying distance and stoppage position of golf ball based on the flying trace of the golf ball. That is, said control section 60 calculates the drop point of golf ball in consideration of the flying velocity and angle of said golf ball, calculates the distance the golf ball runs from the dropped point in consideration of the acceleration and frictional force of golf ball and the like, and then calculates the flying distance and

stoppage position by taking those calculated values into consideration. In this case, said flying distance means the distance from the striking position to the stoppage position of golf ball.

Said control section 60 which has calculated the flying distance and stoppage position in this manner inputs signals of golf course images, which are three-dimensionally proceeded along the moving distance from the striking position to the stoppage position, into said projector 70, whereby the three-dimensional images proceeded from said striking position to said stoppage position can be displayed on the projection screen 80.

Following this, said control section 60 controls said setting plate adjusting means 14 according to the actual height and inclined angle of said stoppage position, whereby said setting plate 12 is adjusted to the height and inclined angle identical to the height and inclined angle of the stoppage position. Therefore, the golf ball prepared for next striking is located on the height and inclined angle identical to the height/angle of the stoppage position of the golf ball flied by the previous striking, whereby the golfer can exercise golf in the state that the height and inclined angle were automatically adjusted to be same condition as in a real golf course. In this case, it is possible to construct in such a manner that the heights and inclined angles of respective points of golf course to be displayed on the projection screen 80 can be stored in the memory section as separate data and said control section 60 will take up and use data corresponding to the height and inclined angle of said stoppage position from the memory section.

Meanwhile, a turning button 50 for adjusting direction may be additionally provided in the striking zone adjacent to said setting plate 12, and it is possible to construct said control section 60, so that it can automatically adjust the inclined angle of three-

dimensional images of golf course displayed on said projection screen 80 and the height and inclined angle of said setting plate according to the adjustment of said turning button 50. That is, if the turning button 50 is rotationally operated in the right and left directions by the golfer, the control section 60 senses this and inputs three-dimensional image signals into said projector 70 so that the display angle of three-dimensional golf course image displayed on said projection screen 80 can be turned to the turning direction of said turning button, and at the same time said control section 60 operates said setting plate adjusting means 14 to adjust the height and inclined angle of said setting plate 12 to be in conformity with the height and inclined angle of the stoppage position in the direction displayed on said projection screen 80.

With this construction, each golfer can select a desired direction according to his (her) ability, taste or topographical condition and strike a golf ball to the direction, whereby equalization of condition to an real golf course can be further enhanced. Unless such a turning button is provided, it is a matter of course that it is preferable to construct the central part of said projection screen 80 in the direction most of golfers strike golf balls in each of striking positions.

In the above, the case that the striking zone 1a is provided with the setting plate 12 and setting plate adjusting means 14 only is explained. However, the present invention can also be applied to the case that a footboard 16 is provided adjacent to said setting plate 12 and a footboard adjusting means is provided below the footboard, in which case it is possible to use various structures having a construction as well as a function equal to those said setting plate adjusting means, as said footboard adjusting means. In this case, said control section 60 adjusts the height and inclined angle of said setting plate adjusting means 14 according to the calculated height and inclined angle of the stoppage position,

and at the same time, controls said footboard adjusting means so that the height and inclined angle of the footboard can be adjusted to be in conformity with the height and inclined angle of a footing place on which the golfer's feet are actually located when the golfer strikes the golf ball which has been positioned on said stoppage position.

Said footboard 16 may be formed as a single part having such a dimension that a golfer can position both of his feet on said footboard. However, it can be preferred to form said footboard 16 as two spaced parts, so that a golfer can position one foot on the one part of the two spaced parts and the other foot on the other part, and each part of said footboard 16 is provided with one footboard adjusting means, so that the inclined angle of each foot can be separately adjusted, thereby forming the height and inclined angle to be identical to those in an real golf course. In addition, it can be more preferred to incorporate said setting plate 12, setting plate adjusting means 14, footboard 16 and footboard adjusting means into one body 10, for easy installation and positioning in a golf practice ranger.

With this construction, the setting plate 12 for supporting a golf ball can be adjusted to a height and inclined angle identical to those of said stoppage position, and the height and inclined angle of the footboard 16 the golfer steps on with his feet also can be adjusted to be in conformity with those of said footing place in the real golf course, whereby the golfer can exercise golf in a condition equal to that of real golf course.

In this case, if a turning button was provided, it is needless to say that, said control section 60 should be constructed in such a manner that the angle of three-dimensional images of golf course displayed on said projection screen 80 can be turned as said turning button 50 is operated, yet still the setting plate adjusting means 14 and said footboard adjusting means can be individually controlled

so that the heights and inclined angles of said setting plate 12 and foot board 16 can be in conformity with the heights and inclined angles of said stoppage position and footing place in the direction displayed on said projection screen 80.

Meanwhile, Figs. 4 to 8 show constructions of various embodiments of said flying trace sensing means. As shown in Fig. 4, said flying trace sensing means 20 may comprise a first light sensor 210, a second light sensor 212, a plurality of third light sensors 214, and a first signal processing section (not shown).

Said first light sensor 210 is provided within a hollow golf tee 200 projectedly mounted on said setting plate 12, and constructed to sense and output the moment when a golf ball located on said golf tee 200 is struck and disappeared, thereby sensing the time when the golf ball is struck. Said second light sensor 212 is provided in a side aside from the front of said golf tee 200, and constructed to sense and output the time when a swung golf club passes a certain point. Said a plurality of third light sensors 214 are densely arranged right and left of said setting plate, and constructed to sense and output the point and time when the struck golf ball passes. And, said first signal processing section is constructed to be inputted with data related to whether the struck golf ball is sensed or not and sensing times by each of said light sensors 210, 212 and 214, and to compare and analyze light sensors which sensed golf ball and time intervals between them, thereby calculating the flying trace such as velocity, angle, and spin of golf ball.

Furthermore, said flying trace sensing means 20 may comprise a fourth light sensor 220, a plurality of fifth light sensors 222, a plurality of contact sensors 224 and a second signal processing section, as shown in Fig. 5.

Said fourth sensor 220 is installed adjacent to the setting plate 12to face a golf ball located on said setting plate 12, so

that it can sense the time when the golf ball located on said setting plate 12 is struck. Said a plurality of fifth light sensors 222 are means for sensing the height when the golf ball passes a certain point, are vertically installed on a side portion in front of said setting plate so that each of fifth sensors is horizontally faced to the area the struck golf ball essentially passes. Said a plurality of contact sensors 224 are provided along the bottom surface 1 adjacent to said projection screen and adjacent with each other, whereby said contact sensors 224 are constructed so that a contact sensor located on a position on which the struck golf ball is dropped after being hit against the projection screen can be switched on and can sense the struck direction of golf ball. And, said second signal processing section is constructed to be inputted with data related to whether the struck golf ball is sensed or not, and sensing times from each of said light sensors 220, 222 and each of said contact sensors 224 and to compare and analyze the light sensors which sensed the golf ball and time intervals between them, thereby calculating the flying trace such as flying velocity, angle and spin of golf ball.

Fig. 6 is a constructional view showing another embodiment of flying trace sensing means according to the present invention. As shown in the drawing, said flying trace sensing means 20 may comprise a sensor group 240 and a third signal processing section.

Said sensor group 240 are formed in a plurality of stages 242, 244, 246 spaced before and behind in front of said setting plate, and each of stages 242, 244, 246 comprises a plurality of light sensors which are densely arranged right and left, so that said stages can sense the flying direction of a struck golf ball and time intervals between them at the moment when the golf ball passes them. In the drawing, said sensor group 240 is shown as consisting of three stages, in which the first stage 242 may be formed more narrowly than the second and third stage. And, the third signal

processing section is constructed to be inputted with data related to whether the struck golf ball is sensed or not, and sensing times from said light sensors of each stage forming said sensor group 240 and to compare and analyze the light sensors which sensed the golf ball and time intervals between them, thereby calculating the flying trace such as flying velocity, angle and spin of golf ball.

In addition, it is possible to further provide a plurality of laser sensors 230 on the ceiling above said setting plate 12, so that said laser sensors 230 could sense the flying trace of golf ball and movement of golfer's body. In this case, the flying trace sensed by said laser sensors 230 can be used as compensation data when said third signal processing section calculates the flying trace, whereby the accuracy of calculated flying trace can be enhanced. Furthermore, if it is constructed so that the sensed movement of golfer's body could be displayed through a separate monitor, the golfer may see the movement of his body and use it as a data for correcting his posture.

Fig. 7 is a constructional view showing another embodiment of flying trace sensing means. As shown in the drawing, said flying trace sensing means 20 can be constructed to comprises a plurality of infrared cameras 250 and a fourth signal processing section. Said a plurality of infrared cameras 250 are installed on the ceiling to be directed toward said setting plate 12 and its surroundings, so that they can take photographs of struck and flying images of golf ball located on said setting plate 12. And, said fourth signal processing section is constructed to be inputted with data related to the flying images of golf ball photographed by respective infrared cameras 250 and to analyze the image signals, thereby calculating the flying trace such as flying velocity, angle and spin of golf ball.

Fig. 8 is a constructional view showing another embodiment of flying trace sensing means. As shown in the drawing, said flying

trace sensing means can be constructed to comprise a plurality of light emission sensors 260, a plurality of light receiving sensors 262, a plurality of contact sensors 264 and a fifth signal processing section.

In particular, said a plurality of light emission sensors 260 and light receiving sensors 262 are provided right and left walls of said golf practice ranger in the pattern of checkers and arranged so that a light signal outputted from each of said light emission sensors 260 is inputted to a corresponding one of said light receiving sensors 262 in one to one relationship. Said a plurality of contact sensor 264 are densely distributed and arranged all over said projection screen 80 in the pattern of checkers, thereby to sense which part of the projection screen the struck golf ball is dashed against. And, said fifth signal processing section is constructed to be inputted with data related to whether the struck golf ball is sensed or not, and sensing times from each of said light emission sensors 260, light receiving sensors 262 and contact sensors 264 and to compare and analyze the light sensors which sensed the golf ball and time intervals between them, thereby calculating the flying trace such as flying velocity, angle and spin of.

Fig. 9 is a constructional view showing that light emission sensors 260 and light receiving sensors 262 can be provided only on the real parts of both of side walls, respectively, differently from Fig.8. Beyond this, it is a matter of course that the constructions and actions of contact sensors 264, the fifth signal processing section and the like in Fig. 8 can be identically applied to those shown in Fig. 9.

Industrial Applicability

As can be seen from the foregoing, according to the present invention provides, a golf simulation system in which three-

dimensional images of golf course is displayed is provided, wherein the height and inclined angle of said setting plate can be automatically adjusted to be equal to the height and inclined angle of the stoppage position. Therefore, a golfer can exercise golf in various inclined angles and topographical conditions like a real golf course, whereby the effect of golf practice can be considerably improved. Furthermore, when two or more golfers play a golf game, victory or defeat can be determined according to true ability of golf like in the real golf course because various topographical conditions are provided like the real golf course, whereby the interest for a golf game in the golf practice ranger can be largely improved.

While this invention has been described in connection with golf simulation systems according to the preferred embodiments of the present invention, it can be appreciated that the present invention is not limited to the disclosed embodiments and the skilled one in the art can variously modify and apply them within the spirit and scope of the appended claims.

Claims

1. A golf simulation system comprising: a flying trace sensing means for sensing a golf ball struck in a striking zone provided in a side of golf practice ranger, a projection screen installed to face said striking zone, a projector for projecting three-dimensional images of golf course onto said projection screen, and a control section for outputting image signals, which proceed with the three-dimensional images of golf course in accordance with the flying trace sensed by said flying trace sensing means, into said projector,

wherein a setting plate for locating a golf ball is provided in said striking zone and a setting plate adjusting means is provided below said setting plate for adjusting the height and inclined angle of setting plate, and

wherein said control section calculates the moved distance and stoppage position of golf ball based on the flying trace of golf ball sensed by said flying trace sensing means, and inputs signals reflecting the three-dimensional images of the golf course along the flying trace into said projector, so that the three-dimensional images of the golf course along the flying trace can be displayed on said projection screen, and said control section controls said setting plate adjusting means in accordance with the height and inclined angle of said stoppage position, so that said setting plate can be automatically adjusted to the height and inclined angle equal to those of said stoppage position.

2. The golf simulation system according to claim 1, wherein a turning button for adjusting direction is provided in the striking zone adjacent to said setting plate, and

wherein said control section controls three-dimensional image signals inputted into said projector, so that the display angle of

three-dimensional golf course image displayed on said projection screen can be turned in accordance with the adjustment of said turning button, and at the same time controls said setting plate adjusting means to adjust the height and inclined angle of said setting plate to be in conformity with the height and inclined angle of the stoppage position in the direction displayed on said projection screen.

3. The golf simulation system according to claim 1, wherein a footboard for golfer is provided adjacent to said setting plate and a footboard adjusting means is provide below said footboard for adjusting the height and inclined angle of said footboard, and

wherein said control section controls said setting plate adjusting means according to the height and inclined angle of said stoppage position, and at the same time, controls said footboard adjusting means so that the height and inclined angle of the footboard are adjusted to be in conformity with the height and inclined angle of the place on which the golfer's feet are actually positioned when the golfer, strikes the golf ball located on said stoppage position.

4. The golf simulation system according to clam 3, wherein a turning button is provided in the striking zone adjacent to said setting plate,

wherein said control section controls three-dimensional image signals inputted into said projector, so that the display angle of three-dimensional golf course image displayed on said projection screen can be turned in accordance with the adjustment of said turning button, and at the same time individually controls said setting plate adjusting means and footboard adjusting means to adjust the inclined angles of stoppage position/footing place in the direction displayed on the projection screen and the front inclined

angles of said setting plate/foot board are to be in conformity with each other.

5. The golf simulation system according to claim 1, wherein said flying trace sensing means comprises a first light sensor provided within a hollow golf tee projectedly mounted on said setting plate to sense the moment of striking the golf ball, a second light sensor provided around said golf tee to sense the swing time of golf club, a plurality of third light sensors densely arranged in a line to sense the point that the struck golf ball passes, and a first signal processing section inputted with sensed signals from said light sensors and calculating the flying trace of golf ball.

6. The golf simulation system according to claim 1, wherein said flying trace sensing means comprises a fourth sensor installed adjacent to the setting plate to sense the time of striking the golf ball, a plurality of fifth light sensors vertically installed on a side portion aside from the front of said setting plate to sense the flight height of struck golf ball, a plurality of contact sensors densely arranged along the bottom surface adjacent to said projection screen to sense a position on which the struck golf ball is dropped after hit against the projection screen, and a second signal processing section inputted with sensed signals from said light sensors and contact sensors and calculating the flying trace of golf ball.

7. The golf simulation system according to claim 1, wherein said fright trajectory sensing means comprises a sensor group formed in a plurality of stages spaced before and behind in front of said setting plate, in which each of stages comprises a plurality of light sensors which are arranged right and left, and a third signal

processing section inputted with sensed signals from light sensors of said sensor group and calculating the flying trace of golf ball, and

wherein a plurality of laser sensors are installed on the ceiling above said setting plate for sensing the flying trace of golf ball and movement of golfer's body.

8. The golf simulation system according to claim 1, wherein said flying trace sensing means comprises a plurality of infrared cameras on the ceiling above said setting plate and a fourth signal processing section inputted with sensed signals from each of said infrared cameras and calculating the flying trace of golf ball.

9. The golf simulation system according to claim 1, wherein said flying trace sensing means comprises a plurality of light emission sensors installed on one side of left and right walls of golf practice ranger, a plurality of light receiving sensors installed on the other side of right and left walls to individually receive a light signal generated from each of said light emission sensors, the number of light receiving sensors being identical with that of said light emission sensors, a plurality of contact sensors densely arranged all over said projection screen to sense the part to be touched by the struck golf ball, and a fifth signal processing inputted with sensed signal from each of said sensors and calculating the flying trace of golf ball.

FIG 1

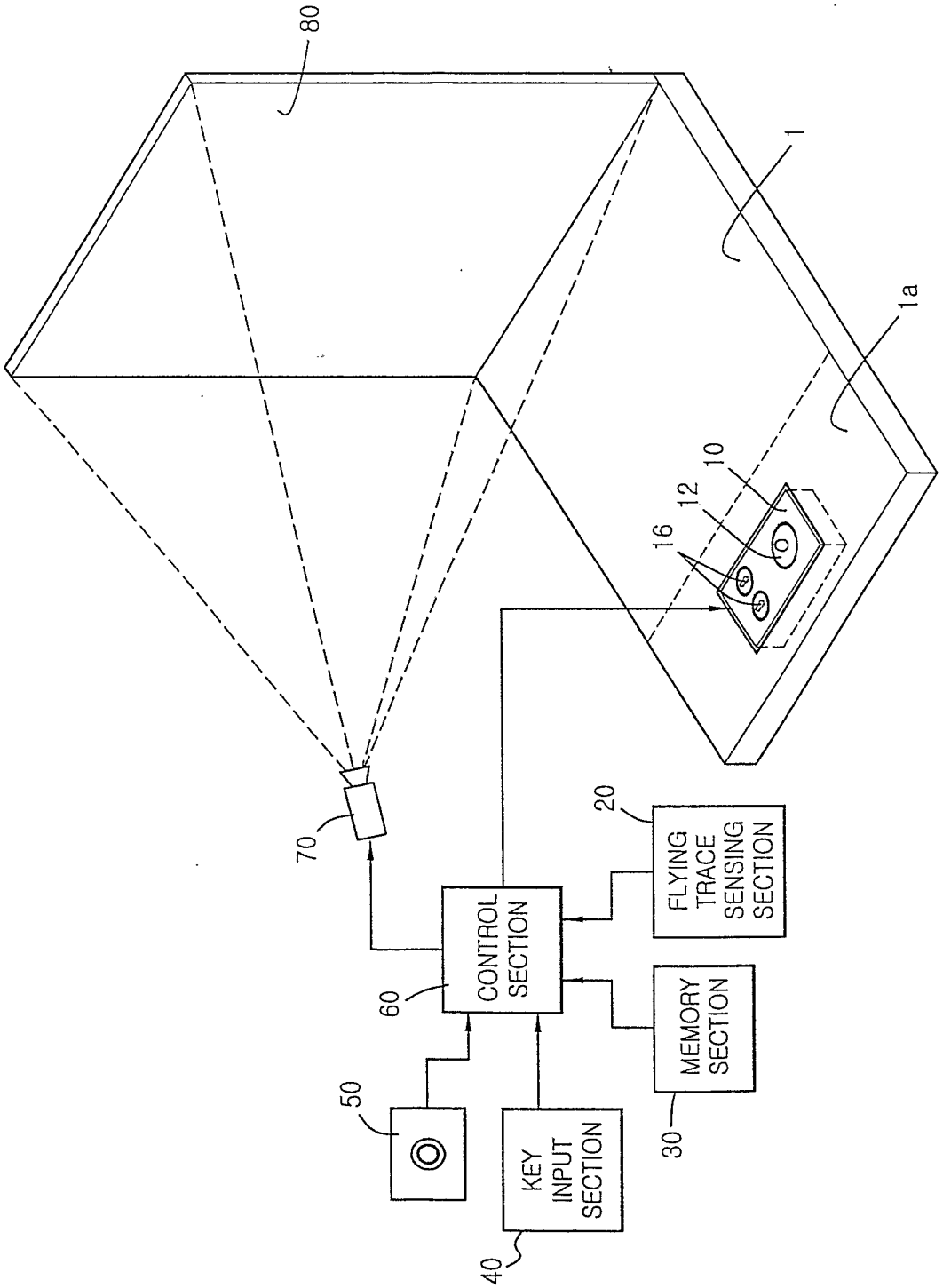

80
1
1a
10
12
16
70
20
FLYING TRACE SENSING SECTION
CONTROL SECTION
60
MEMORY SECTION
30
50
KEY INPUT SECTION
40

FIG 2

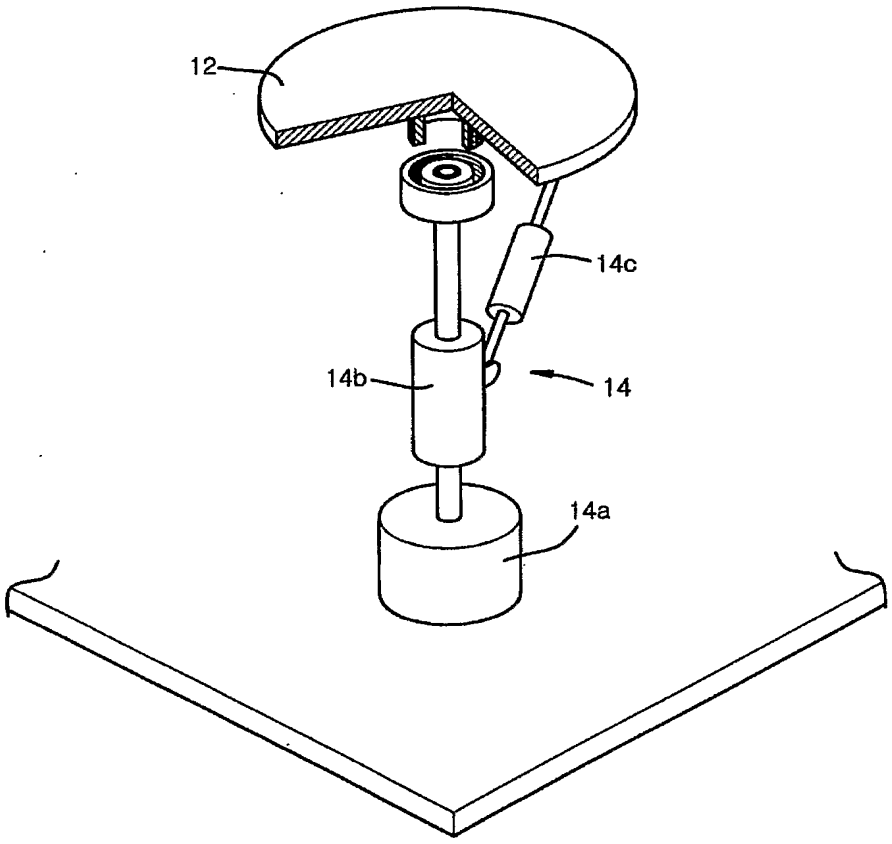


FIG 3

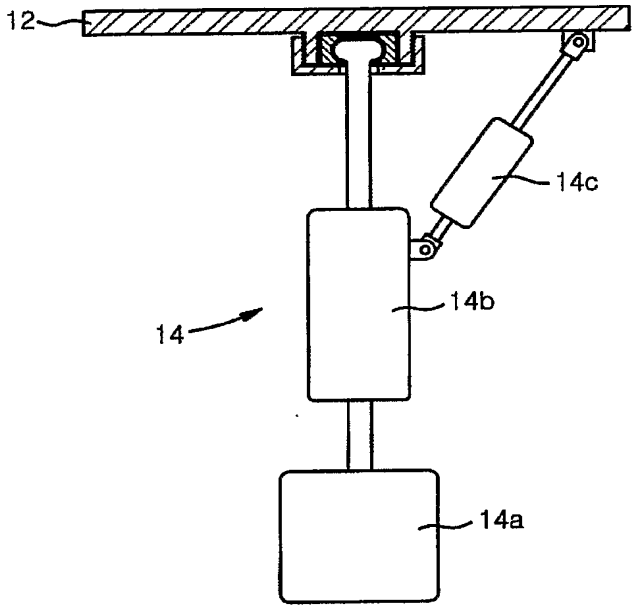


FIG 4

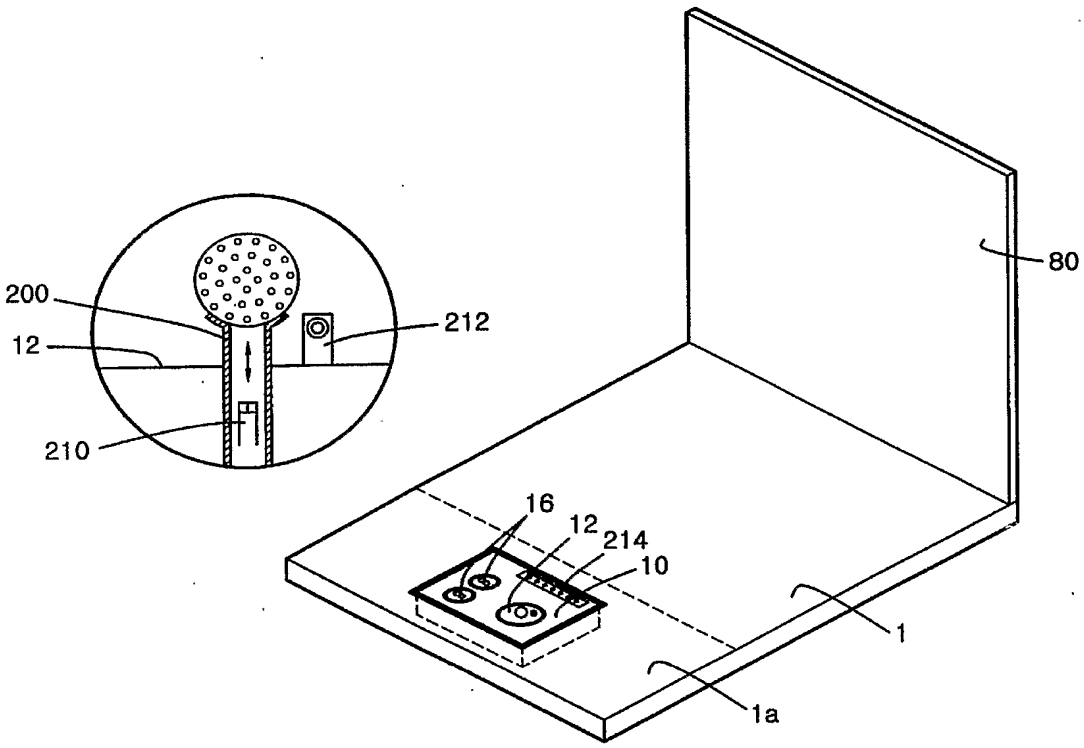


FIG **5**

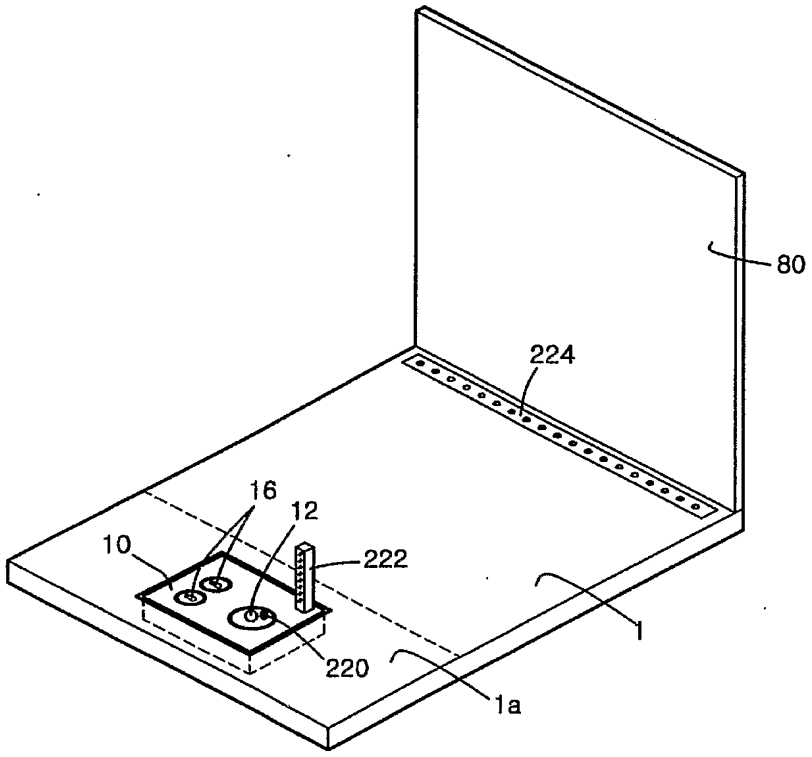


FIG **6**

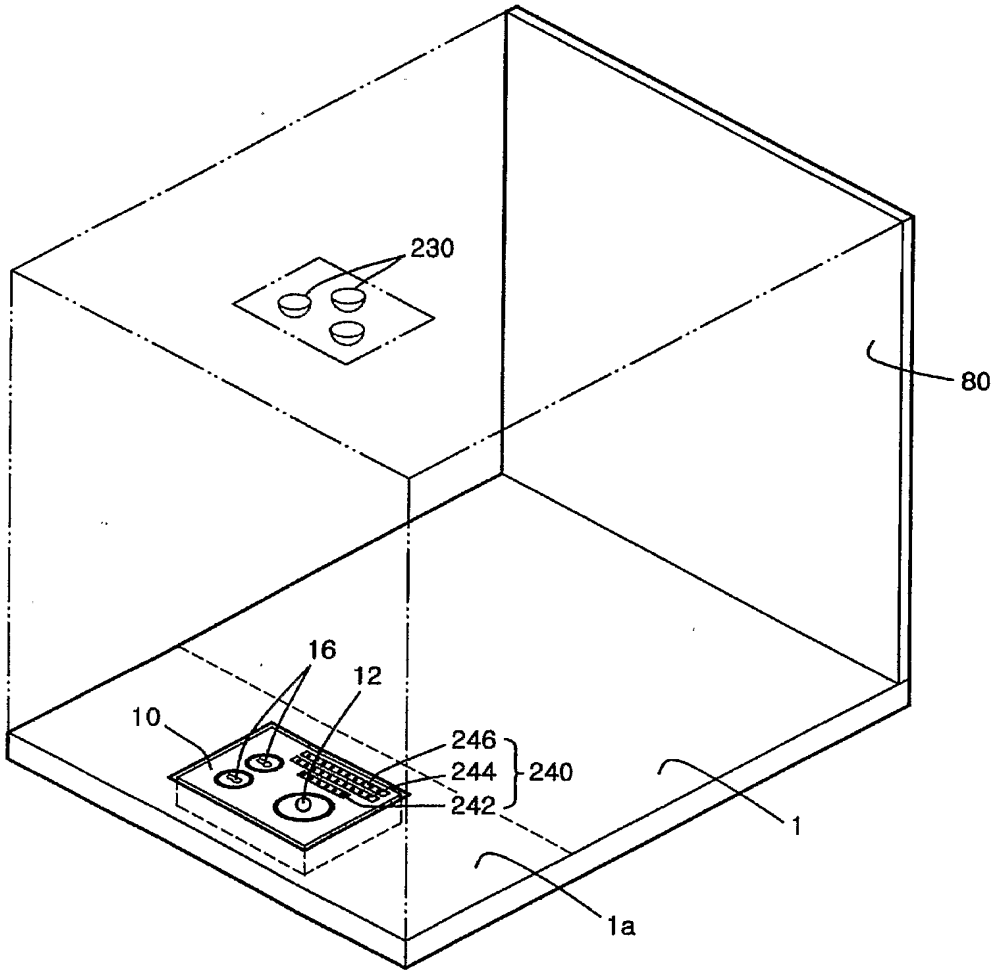


FIG 7

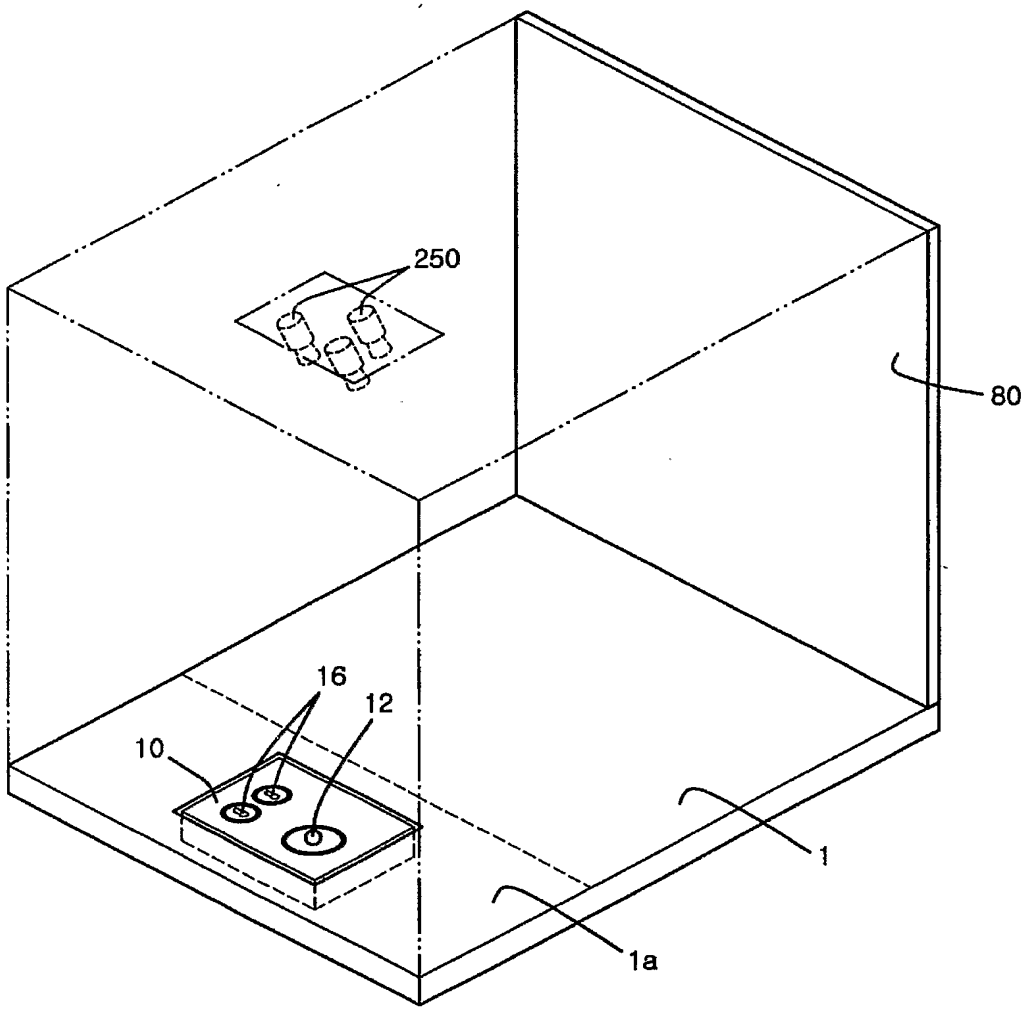


FIG **8**

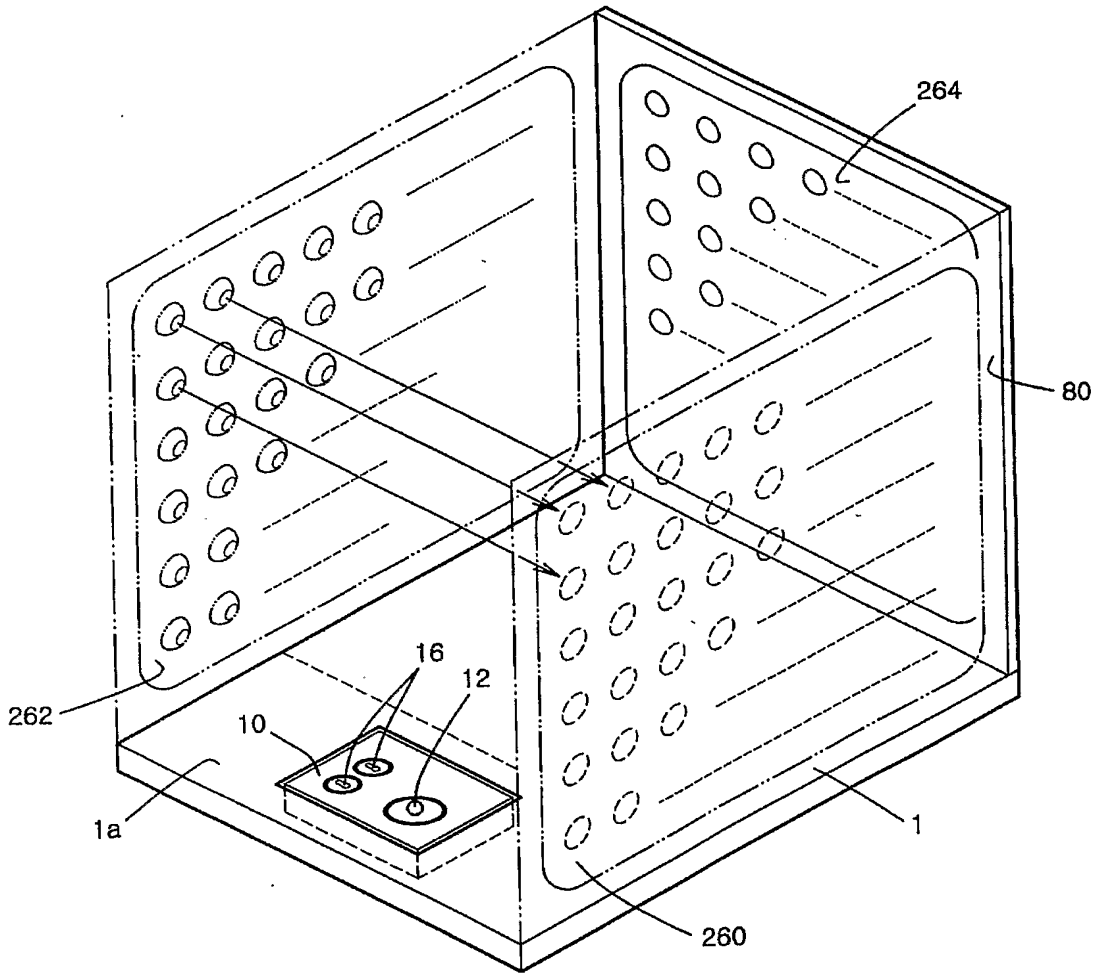
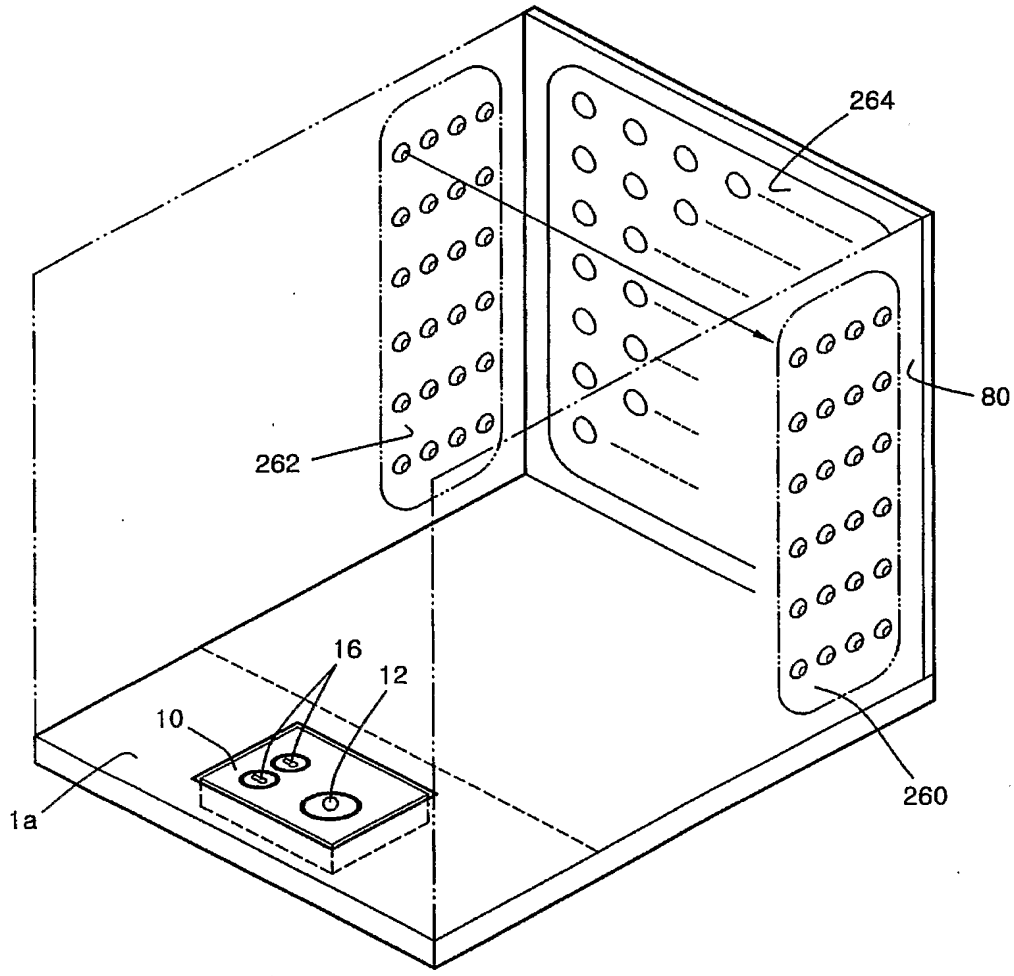


FIG 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR02/00623

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 A63B 69/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7 A63B. GO6F. HO4N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
KR. JP: IPC as above

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 2001-0016043 A(OH JONG ROCK)05 MARCH 2001 See the whole document	1-9
Y	US 4875684 A(BENILAN JACQUES)24 OCTOBER 1989 See the whole document	1-9
A	US 5486001 A(RICK BAKER)23 JANUARY 1989 See the whole document	1-9
A	JP 08-215363 A(KAWASAKI CORP KK)27 AUGUST 1996 See the whole document	1-9
A	US 5413345 A(GEORGE S.NAUCK)09 MAY 1995 See the whole document	1-9

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 MAY 2002 (30.05.2002)	31 MAY 2002 (31.05.2002)

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea	SEOK, Ki Cheol
Facsimile No. 82-42-472-7140	Telephone No. 82-42-481-5455

Form PCT/ISA/210 (second sheet) (July 1998)